

5 **METHODS, APPARATUS, AND ARTICLES OF MANUFACTURE**
 FOR PROVIDING A FOAM GLOVE

RELATED APPLICATIONS

10 This application claims the benefit of U.S. Provisional Application No. 60/464,506 entitled "Methods, Apparatus and Articles of Manufacture for Providing a Foam Glove" filed on April 21, 2003, which is incorporated herein by reference.

FIELD OF THE INVENTION

15 This invention is directed to methods, apparatus, and articles of manufacture for an article of clothing, and more precisely relates to methods, apparatus, and articles of manufacture for providing a foam glove.

BACKGROUND OF THE INVENTION

20 Conventional gloves can provide a gripping surface for use in working environments. Similar types of gripping surfaces can be applied to wearing apparel or skid resistant floor coverings in order to provide a textured surface for gripping. However, gloves with a conventional gripping surface can be relatively heavy, and can preclude preferable breathing characteristics of the glove. These occurrences can
25 interfere with the comfort of the glove for a wearer or user.

Conventional manufacturing processes for such gloves can include dipping glove liners into various coatings. However, with certain types of glove fabrics, undue absorption and strikethrough of the applied dipped coating into and through the glove liners to the internal surfaces can occur. These occurrences can interfere with desired properties of the internal surfaces, which can include warmth, softness, and absorbency. These occurrences can also interfere with the comfort of the glove for a wearer or user.

Therefore, a need exists for methods, apparatus, and articles of manufacture for providing a textile supported foam glove.

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SUMMARY OF THE INVENTION

Methods, apparatus, and articles of manufacture according to various aspects and embodiments according to the invention address some or all of these issues and combinations of them. They do so by providing in at least one aspect of the invention, a method for manufacturing a textile supported foam glove. The method includes applying a first component to a portion of a textile shell, applying a second component to the portion of the textile shell, wherein a polymeric coating adheres to the textile shell, the polymeric coating comprising a base polymer with a sufficient amount of air mixed with the base polymer to lower the density of the base polymer between about 10 to 50% of the original density of the base polymer.

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Furthermore, in another aspect of the invention, an apparatus for manufacturing a textile supported foam glove is provided. An apparatus includes a glove form adapted for receiving a textile shell with a surface for receiving a polymeric coating,

wherein the polymeric coating is supported in part by the surface of the textile shell, the polymeric coating including a base polymer with a sufficient amount of air mixed with the base polymer to lower the density of the base polymer between about 10 to 50% of the original density of the base polymer.

5 Moreover, another aspect of the invention provides an article of manufacture including a textile shell with a surface, a polymeric coating, wherein the polymeric coating is supported in part by the surface of the textile shell, the polymeric coating including a base polymer with a sufficient amount of air mixed with the base polymer to lower the density of the base polymer between about 10 to 50% of the original
10 density of the base polymer.

Objects, features and advantages of various methods, apparatus, and articles of manufacture according to various embodiments of the invention include:

- (1) Methods for manufacturing a textile supported foam glove;
- (2) Apparatus for manufacturing a textile supported foam glove; and
- 15 (3) Articles of manufacture providing a textile supported foam glove.

Other objects, features and advantages will become apparent with respect to the remainder of this document.

BRIEF DESCRIPTION OF THE DRAWINGS

20 FIG. 1 is an illustration of an article of manufacture in accordance with various disclosed embodiments of the invention.

FIG. 2 is a block diagram illustrating a manufacturing process for use with an associated apparatus to provide a textile supported foam glove in accordance with various disclosed embodiments of the invention.

5 DETAILED DESCRIPTION

The invention is directed to methods, apparatus, and articles of manufacture for providing a textile supported foam glove. References will now be made in detail to the disclosed embodiments of the invention which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the
10 drawings to refer to the same elements.

FIG. 1 illustrates an article of manufacture in accordance with various disclosed embodiments of the invention. The article is a textile supported polymeric glove 100 with an enhanced grip 102. An example of a material for a suitable textile shell to support the glove 100 can include, but is not limited to, nylon, polyester, aramid,
15 cotton, wool, rayon, acrylic, and blended yarns. Examples of a suitable polymer for the glove 100 can include, but are not limited to, acrylonitrile butadiene rubber, polymer latex VTLA, Synthomer 48C40, Synthomer 6000, Dupont Neoprene 750, Witcobond 506, Barrier Pro 2000, and natural latex. An exemplary article of manufacture is a glove manufactured and distributed by Best Manufacturing Company
20 under the trademark Zorb-IT™. Other articles of manufacture can be produced in accordance with various embodiments of the invention. For example, a coated fabric such as a textile fabric with a polymeric coating can be produced in accordance with one embodiment of the invention.

The enhanced grip **102** of the glove **100** is provided by a soft, malleable, air whipped, polymeric film coating **104** applied to a glove liner or textile shell **106**. Air cells within the film coating **104** provide the film coating **104** with a relative softness that adsorbs liquids that would ordinarily interfere with surface-to-surface contact necessary for sufficient grip of an object with the glove **100**. A polymeric compound in which the glove **100** is dipped during a process or method, such as the method **200** illustrated in FIG. 2, has a lowered density caused by air homogenously mixed into the polymeric compound through the use of a surfactant and a relatively higher level of agitation than ordinarily used with latex compounds. Note that a relatively slow or low rate of agitation will not ordinarily mix air into a latex or polymeric compound, thus a sufficient amount of agitation must be performed to mix or to incorporate air with the polymeric compound.

FIG. 2 illustrates a manufacturing process for use with an associated apparatus to provide a textile supported foam glove in accordance with various embodiments of the invention. A process or method **200** for making a textile supported foam glove, such as the glove **100** described in FIG. 1, begins at block **202**.

Block **202** is followed by block **204**, in which a glove form (not shown) is heated to approximately 100°F - 130°F (37.8°C – 54.4°C). A suitable glove form can be a metal hand shaped former. Conventional heating equipment can be used to increase or decrease the temperature of the glove form as needed.

Block **204** is followed by block **206**, in which a textile shell, such as **106** shown in FIG. 1, is placed on the glove form designed for the specific style of dipping to be applied. A suitable textile shell can be a 4/70 denier nylon yarn, knitted on a 15 gauge

Shima Seki knitting machine. Other types of textiles, fabrics, and shells can be used in accordance with various embodiments of the invention.

Block **206** is followed by block **208**, in which the textile shell **106** is dipped into a first dip tank containing a coagulant-type solution such as a calcium nitrate formulation. By way of example, a first dip tank is pre-prepared containing a coagulant-type solution such as water, calcium nitrate, and surfactant. The calcium nitrate formulation in this example has a specific gravity between approximately 1.00 to 1.10, and a preferred specific gravity of approximately 1.05, with the following components: approximately 5.0% by weight $\text{CA}(\text{NO}_3)_2$; approximately 0.02% Triton X-100 (surfactant), distributed by the Union Carbide Corporation; and approximately 94.5% water. Note that other similar non-ionic surfactants to Triton X-100 can be used. Other mixtures, percentages, and/or materials can be used in the formulation accordance with various embodiments of the invention. The textile shell **106** can then be sprayed with or dipped into the coagulant-type solution in the first dip tank.

Block **208** is followed by block **210**, in which after applying the coagulant-type solution to the initially coated textile shell, the initially coated textile shell is dried. By way of example, the initially coated textile shell **106** can be air dried for approximately 1 – 5 minutes, and preferably air dried for approximately 3 minutes total. For examples, the glove form with the initially coated textile shell **106** can be hung or otherwise supported with the fingers of the initially coated textile shell **106** extending downward for approximately 1.5 minutes, and then the glove form positions the fingers of the initially coated textile shell **106** extending upward for another 1.5

minutes. Other times and positions can be utilized in accordance with various embodiments of the invention.

Block **210** is followed by block **212**, in which the initially coated textile shell is dipped into a second dip tank. By way of example, a second dip tank is pre-prepared containing a foamed polymeric compound with a lowered density of approximately 10 – 50% by weight, preferably reduced by approximately 30% by weight from the original density of the base polymer. A suitable polymeric compound can contain components in the respective approximate ranges and preferred amounts described in Table 1 below.

10 Table 1: Suitable Polymeric Compound

Component	Range	Preferred (PHR)	Distributed By
Reichhold 68079 nitrile latex	100	100	Dow Reichhold Latex LLC
KOH	0.3 – 0.75	0.62	J.T. Baker, Air Products
Zinc Oxide (ZnO ₂)	1 – 3	1.5	Zinc Corporation of America
Dowfax 2A1	0.2 – 0.6	0.451	Dow Chemical Company
Tego 4710	0.09 – 0.2	0.15	Goldschmidt Chemical

			Corporation
Michemlube 124	0.5 – 1.5	1.0	Michelman Inc.
TiO ₂	0.37 – 0.67	0.5	Sun Chemical Corp
Octojet 588	0.06 – 1.0	0.088	Tiarco Chemical
Alco HPT/Bermocoll EHM	1.3 – 3.0	0.24	Alco Chemical / Akzo Nobel

Examples of properties and characteristics that the various components in the polymeric compound can include, but are not limited to, are as follows. The Reichhold 68079 nitrile latex is a base polymer for the polymeric compound, and provides softness and foam stability. Other types of suitable base polymers can include, but are not limited to, acrylonitrile butadiene rubber, polymer latex VTLA, Synthomer 48C40, Synthomer 6000, Dupont Neoprene 750, Witcobond 506, Barrier Pro 2000, and natural latex.

Potassium hydroxide (KOH) is a stabilizer and pH modifier for the polymeric compound. Other types of suitable materials similar to potassium hydroxide can include, but are not limited to, ammonia hydroxide, AMP 95, and sodium hydroxide.

Zinc oxide (ZnO₂) provides crosslinking of the Reichhold 68079 nitrile latex, or other suitable base polymer, for improved physical properties. Other types of suitable materials similar to zinc oxide can include, but are not limited to, sulfur, and ZMTI.

The Dowfax 2A1 (dophenyl sulfonate derivative) disperses and maintains size

and distribution of air cells in the polymeric compound, and is a foam stabilizer and leveling agent. Other types of suitable materials similar to Dowfax 2A1 can include, but are not limited to, Aerosol DPOS-45, Rhodocal DSB, Sandet ALH.

5 The Tego 4710 (polyether modified polysiloxane) is a heat sensitizer that gels the polymeric compound in the presence of heat to form a relatively stable film. Other types of suitable materials similar to Tego 4710 can include, but are not limited to, Coag WS, and Tego 4910.

The Michemlube 124 is a microcrystalline paraffin wax and detackifies the finished polymeric film, and is a plasticizer, anti-ozonant, and anti-block agent.
10 Other types of suitable materials similar to Michemlube 124 can include, but are not limited to, Chemcor Paraffin 60.

Octojett 588 (carbon black) is a colorant for the polymeric compound. Other types of suitable materials similar to Octojett 588 can include, but are not limited to, TiO₂, Red 25WDN01, E-5260 Red, and E-8717 Brown. Other colorants such as color
15 pigments can also be added to the polymeric compound so long as the air entrapment and polymeric compound stability are not adversely affected.

Alcogum HPT/Bermocoll EHM (polyacrylate, ethyl hydroxyethyl cellulose) provides a near Newtonian-like flow properties and stabilizes the foamed air cells. Preferably, the viscosity of the foam is approximately 1800-2400 centipoise at ambient
20 temperature or 1800 mPa. Other types of suitable materials similar to Alcogum HPT/Bermocoll EHM include, but are not limited to, Alcogum AN10, and Optigel LX.

Other mixtures, percentages, and/or materials can be used in the polymeric compound in accordance with various embodiments of the invention.

Air is then added or whipped, or otherwise added, into the polymeric compound causing air entrainment of foaming within the compound. Density of the polymeric compound can be lowered to a range of approximately 10 - 50% by weight. Preferably, the density is lowered to approximately 30% by weight. For example, an 8
5 fluid ounce (0.23 liter) amount of polymeric compound ordinarily weighs approximately 0.62 lbs. (280 grams). After air is mixed into the polymeric compound, a foamed polymeric compound results weighing approximately 0.44 lbs. (200 grams), thus lowering the density by approximately 30% by weight. Note that a relatively slow or low rate of agitation will not ordinarily mix air into a latex or polymeric
10 compound, thus a sufficient amount of agitation must be performed to mix or to incorporate air with the polymeric compound. The whipped air in the polymeric compound causes a subsequent reduction of the hydrostatic pressure of the polymeric compound against the textile shell 106. The whipped air in the polymeric compound also results in reduced penetration of the polymeric compound into and through the
15 textile shell 106. Furthermore, the calcium nitrate formulation on the textile shell 106 coagulates the polymeric compound before the compound penetrates through the textile shell 106.

Block 212 is followed by block 214, in which the coated glove is dried. By way of example, the coated glove 100 is dried for approximately 1 - 6 minutes, preferably air dried for approximately 3 minutes total. For example, the coated glove
20 100 is removed from the foamed polymeric compound, and then the fingers of the glove 100 are positioned downward for approximately 1.5 minutes, and then the fingers of the glove 100 are positioned upward for approximately 1.5 minutes. Other

times and positions can be utilized in accordance with various embodiments of the invention.

Block **214** is followed by block **216**, in which the coated glove **100** is leached. By way of example, the coated glove **100** is leached in room temperature clean water for approximately 0.5 – 2 minutes, and preferably for approximately 1 minute. In this manner, some or all of the calcium nitrate is removed while leaching the glove **100**, reducing the tackiness of the coated glove **100** and slightly compressing the polymeric surface. Other times, temperatures, and positions can be utilized in accordance with various embodiments of the invention.

Block **216** is followed by block **218**, in which the coated glove **100** is dried. By way of example, the coated glove is dried for approximately 2 – 6 minutes, and preferably air dried for 4 minutes. For example, the fingers of the coated glove **100** can be positioned downward for approximately 4 minutes.

The glove can be further dried by means of a drying oven or other heating device. By way of example, the coated glove **100** is hung for approximately 7 - 20 minutes, preferably for 9 minutes, at a temperature between approximately 190 - 210°F (87.8 – 98.9°C), and preferably at a temperature of 200°F (93.3°C). During this time, the coating (such as **104** shown in FIG. 1) on the glove **100** dries. Other times, temperatures, and positions can be utilized in accordance with various embodiments of the invention.

Block **218** is followed by block **220**, in which the coated glove **100** is cured. By way of example, the coated glove is heated in a cure oven for approximately 15-25 minutes, preferably approximately 20 minutes, at a cure temperature of between

approximately 300 – 330°F (166.7 – 183.3°C), and preferably at a cure temperature of approximately 315°F (175°C). Other times, temperatures, and positions can be utilized in accordance with various embodiments of the invention.

Block **220** is followed by block **222**, in which the process or method **200** ends.

5 The process or method **200** provides an article of manufacture, such as a glove **100** shown in FIG. 1 with an enhanced grip **102** provided by a soft, malleable, air whipped, polymeric film coating **104** applied to a glove liner or textile shell **106**. Air cells within the film coating **104** provide the film coating **104** with a relative softness that adsorbs liquids that would ordinarily interfere with surface-to-surface contact
10 necessary for sufficient grip of an object with the glove **100**.

While the above description contains many specifics, these specifics should not be construed as limitations on the scope of the invention, but merely as exemplifications of the disclosed embodiments. Those skilled in the art will envision many other possible variations that within the scope of the invention.